ISSUE I-6: VERIZON MAY NOT IMPOSE INFEASIBLE METHODS FOR DETERMINING TOLL VERSUS LOCAL TRAFFIC.

Q. ISSUE I-6 RELATES TO HOW THE PARTIES WILL DETERMINE WHETHER TRAFFIC IS LOCAL OR TOLL IN NATURE. CAN YOU DESCRIBE COX'S POSITION AND THE REASONS FOR IT?

A. Cox has proposed that the parties base determinations of whether a call is local or toll on the NXX codes assigned to the originating and terminating telephone numbers for the call. This is the method traditionally used in the industry, as reflected in prior interconnection agreements and local exchange tariffs across the country. It is implemented in all standard billing software and uses the widely-available information published in the Local Exchange Routing Guide, which facilitates verification of the local or toll status of a call. I am unaware of any local exchange carrier that uses any other method to determine whether a call is local or toll in nature.

As an alternative to the standard mechanism, Verizon has proposed that the Parties compare "the originating and terminating points of the complete end-to-end communication." To implement this approach, the Parties would have to look beyond the assigned NXX codes and ascertain exactly where the communication embodied in a call begins and ends. For instance, Cox would be obligated to determine where each call from a leaky PBX actually originated. Similarly, on each call to an ISP, both Parties would be required to determine whether the call communicated only with the local server to pick up e-mail or with the Internet. I do not know of any technology that would permit Cox or any other carrier to make such determinations, on a call-to-call basis or otherwise. Indeed, to my knowledge, there is no industry-accepted standard for what would

constitute the "originating and terminating points of the complete end-to-end communication." Thus, unlike Cox's proposal, which is based on well-established industry standards, Verizon's proposed language raises significant unanswered questions.

Further, Verizon's proposed language would have the effect of undercutting the implementation of the *ISP-Bound Traffic Order.* Under Verizon's language, it is likely that much ISP-bound traffic would be treated as toll traffic, which is contrary to the rules adopted in that order. This concern provides a further basis for rejecting Verizon's proposed language.

Verizon argues that this language is necessary to address an alleged concern created by the assignment of telephone numbers from one local calling area to customers who are located in another local calling area. Even if this were the problem that Verizon claims it to be, the Verizon language is the equivalent of using an elephant gun on a mouse, because it covers much more than the supposed problem. In particular, as described above, Verizon's language would require Cox and other CLECs to devise a method to determine the actual end-to-end points of communication for all of their customers' calls, not just those to customers supposedly located outside the local calling area of their assigned numbers. Moreover, Verizon has other remedies available to it if it believes CLECs are engaged in unlawful number assignment practices, including seeking the assistance of state authorities under state laws and regulations to address those practices. Given that Verizon has made such efforts in the past (for instance in Maine), there is no reason to believe it cannot do the same in Virginia if its claims have merit.

ISSUE I-7: VERIZON MAY NOT REQUIRE THAT COX ENGINEER AND/OR FORECAST VERIZON'S TRUNK GROUPS.

Q. DR. COLLINS, ISSUE I-7 CONCERNS COX'S CLAIM THAT VERIZON IS ATTEMPTING TO REQUIRE COX TO FORECAST THE TRAFFIC ORIGINATED BY VERIZON'S CUSTOMERS THAT TERMINATES TO COX'S CUSTOMERS. IS THAT THE CASE?

A. Yes, it is. Even though Cox does not have access to those customer's records, does not have the ability to measure their total originating traffic, and does not determine how Verizon chooses to route the traffic internal to the Verizon network, Verizon has insisted that Cox should provide forecasts of the traffic generated by Verizon customers that will be sent to Cox for termination.

Verizon's proposed contract language, which places the forecasting responsibility on Cox, is inconsistent with the Parties' responsibilities under the rest of the agreement. Notably, the trunk administration language proposed by Verizon in section 10.3.1 clearly indicates that Cox and Verizon are individually responsible for engineering their own one way trunk groups to carry traffic to one another. ("10.3.1 Trunk Administration. For Traffic Exchange Trunk groups, Cox will be responsible for monitoring traffic loads and service levels on the one-way trunk groups carrying traffic from Cox to Verizon; and Verizon will be responsible for monitoring traffic loads and service levels on the one-way trunk groups carrying traffic from Verizon to Cox"). Yet Verizon wants Cox to provide the traffic forecast for calls to Cox customers initiated by Verizon's customers. The Verizon position on this issue simply does not make sense; Cox has no access to the Verizon engineering data or internal traffic forecasts that would be necessary to make the

forecast required by Verizon's proposed language and Verizon has not offered to make this information available to Cox. Further, Verizon's proposal would place the costs of forecasting the traffic generated by Verizon's own customers on Cox.

The language proposed by Cox also is consistent with the language in every other interconnection agreement Cox has negotiated with CLECs, CMRS providers and incumbent LECs, including all of Cox's other interconnection agreements with Verizon affiliates including Verizon South in Virginia. Absent a compelling explanation to justify deviating from existing standards, the FCC should not permit Verizon to impose these new obligations on Cox.

Verizon's explanation for its refusal to forecast its own traffic is that it believes Cox is in a better position than Verizon to make such a forecast. This explanation assumes that Cox holds all of the information necessary to make Verizon's forecasts, and that Verizon does not hold any of that information. As shown above, this is incorrect because Cox does not have intimate knowledge of Verizon's network or its plans. In addition, in Cox's proposed section 10.3.2, Cox already has agreed to provide Verizon with advance warning of any event that could lead to significant changes in traffic patterns. Finally, Cox has every incentive to ensure that Verizon is timely informed of any changes in likely demand resulting from changes in Cox's service offerings or customer base because it is important to Cox to ensure that calls from Verizon customers to Cox customers do not experience blocking. Thus, Verizon will have the information it needs to forecast its outgoing traffic.

Cox's language is effective, fair and balanced.

Q. HOW CAN THE FCC RESOLVE THE DIFFERENCE BETWEEN COX AND VERIZON ON THIS ISSUE?

A. The FCC can resolve this issue by recognizing that historically all telephone companies have done their own traffic forecasting and retaining that historic approach in the agreement. There are two primary reasons the FCC should adopt this solution. First the level of service each company provides to its own customers depends on this forecast, and the company's reputation for quality service depends on it. Second, when a call traverses two networks and one provides poor service, the calling and called parties cannot distinguish which network is at fault but is likely to blame the "new" company for any problem. Cox does not want to accept the responsibility for guessing what Verizon's traffic levels will be when Verizon can provide a more reliable and accurate forecast.

If the FCC approves Cox's proposed language, the result will be a balanced treatment of forecasting and one that can be implemented.

ISSUE I-8: VERIZON MAY NOT MONITOR OR AUDIT COX'S ACCESS TO AND USE OF CUSTOMER PROPRIETARY NETWORK INFORMATION MADE AVAILABLE TO COX THROUGH THE INTERCONNECTION AGREEMENT.

Q. DR. COLLINS, ISSUE I-8 ADDRESSES VERIZON'S DEMAND FOR THE ABILITY TO MONITOR COX'S ACCESS TO AND USE OF CUSTOMER PROPRIETARY NETWORK INFORMATION (CPNI) WHICH VERIZON MAKES AVAILABLE TO COX THROUGH THE INTERCONNECTION AGREEMENT. WHAT POSITION DOES COX HAVE ON THIS ISSUE?

A. Verizon's position is set out in the language it has insisted should be included in the Interconnection Agreement. That language is as follows:

> Verizon shall have the right to monitor and/or audit Cox's access to and use and/or disclosure of Customer Proprietary Network Information that is made available by Verizon to Cox pursuant to this Agreement to ascertain whether Cox is complying with the requirements of Applicable Law and this Agreement with regard to such access, use, and/or disclosure. To the extent permitted by Applicable Law, the foregoing right shall include, but not be limited to, the right to electronically monitor Cox's access to and use of Customer Proprietary Network Information that is made available by Verizon to Cox pursuant to this Agreement.

The Verizon language assumes a number of things that are in fact not supportable. First, Verizon has no statutory authority to act as an arm of either state or federal law enforcement bodies. Cox is obligated by agreement and the law to act responsibly and in accordance with the law as to the CPNI information.

Second, electronic monitoring by Verizon of Cox's use of the information would require intrusive access to Cox's internal systems, which support the storage, retrieval, and application of such information. These systems are part of a coherent set of systems that assist in managing practically all aspects of Cox's business, and access to one component would give Verizon access to all components. In other words, Verizon's proposed language would have the effect of giving Verizon the ability to obtain Cox's most important confidential business information, including the identity of Cox's business prospects. Cox simply cannot grant rights to Verizon, under the guise of an interconnection agreement, that would give Verizon that power.

Third, Cox, not Verizon, is liable for Cox's violations of CPNI requirements, so there is nothing for Verizon to protect itself against. Finally, even if Verizon could be subjected to liability, it already has sufficient remedies available to it under the proposed agreement, including indemnification.

Verizon's justification for its proposal is that its customers expect it to safeguard their CPNI and that its customers will hold it responsible for any inappropriate use of CPNI. Verizon has not explained why contractual language prohibiting Cox from abusing CPNI, when combined with the existing indemnification provisions, would not be sufficient to assuage these concerns. Verizon's supposed concerns are particularly difficult to understand given that it never has indicated to Cox that it has received even a single complaint that Cox has abused its access to CPNI. Further, Verizon's proposed language would not prevent Cox (or any other carrier) from abusing CPNI because monitoring and audits would detect abuses only after they occur, so the supposed purpose of the monitoring and audit provision would not be achieved.

Q. HOW WOULD YOU PROPOSE THE FCC DEAL WITH THE VERIZON LANGUAGE?

A. The FCC should reject Verizon's proposed language. The existing provisions of the agreement and federal law are sufficient to protect Verizon customers' CPNI.

ISSUE I-9: VERIZON MAY NOT LIMIT OR CONTROL RATES AND CHARGES THAT COX MAY ASSESS FOR ITS SERVICES, FACILITIES AND ARRANGEMENTS

Q. DR. COLLINS, YOU CLAIMED IN YOUR SUMMARY OF THE ISSUES FOR ISSUE I-9 THAT VERIZON HAS ATTEMPTED TO USE THE INTERCONNECTION

AGREEMENT TO ESTABLISH CAPS ON THE RATES AND CHARGES THAT COX COULD TARIFF FOR COX'S SERVICES, FACILITIES AND SERVICE ARRANGEMENTS. WOULD YOU CLARIFY WHAT THE SUBSTANCE OF THIS ISSUE IS, AND DESCRIBE COX'S POSITION?

A. Verizon apparently is of the opinion that, because it has the dominant presence in the local exchange market, its rates and its charges should be the standard by which all other carriers' rates are judged. To that end, Verizon has proposed in one section of the Agreement that:

> "**§20.3** . . . Cox may not charge Verizon a rate higher than the Verizon rates and charges for the same services, facilities and arrangements."

This language sets an upper bound on Cox's rates for services provided to Verizon that cannot be exceeded, even if Cox obtains affirmative approval of a rate from a state or federal regulator. Verizon's explanation for this rate cap is that its rates are closely monitored by regulators, and therefore are known to be reasonable. This does not justify using Verizon's rates to set a cap.

Initially, just because a rate allegedly is reasonable for Verizon does not mean it is reasonable for Cox or any other carrier. Cox's cost structure is different than Verizon's for many reasons, not the least of which is Verizon's purchasing power, now vastly expanded through its merger into the new Verizon. If Cox's cost basis is higher than Verizon's, then Verizon's caps would, at a minimum, narrow Cox's margin to cover

those costs and could, in fact, result in service priced below cost. The result would be to decrease Cox's ability to sustain itself in the marketplace.

Second, to the extent that Verizon does believe that Cox's rates are unreasonable, it is not without remedy. As Verizon itself has explained, if Cox wishes to charge rates that exceed those charged by Verizon, it has to justify those rates to the Virginia SCC or to the FCC. Verizon will have an opportunity to challenge those rates when the regulator considers them and, to the extent Cox actually offers service at rates above those of Verizon, through complaints and similar state-level proceedings. No contractual language is required to give Verizon these rights; they exist in both the state and federal regulatory frameworks.

Verizon also argues that its rates should set the cap because it is required to interconnect with CLECs as a matter of federal law. This is a non sequitor. Cox also is required to interconnect with Verizon, but that does not mean that Cox could obtain that interconnection for free by setting its own rates at zero. In fact, the interconnection requirement has no relationship to the rates charged for any services offered because those rates are governed by separate principles of federal and state law, and therefore should have no bearing on the resolution of this issue.

Q. WHAT SHOULD THE FCC DO TO ADDRESS THIS ISSUE?

A. I recommend that the FCC strike the language in its entirety so that each carrier can set its own rates and charges, subject to the requirements of the relevant state or federal regulator. The FCC should reject Verizon's proposed language.

ISSUE I-10: VERIZON MAY NOT UNREASONABLY TERMINATE AN INTERCONNECTION AGREEMENT.

Q. DR. COLLINS, ISSUE I-10 ADDRESSES THE TERMS UNDER WHICH THE AGREEMENT BETWEEN COX AND VERIZON CAN BE TERMINATED. CAN YOU EXPLAIN THE ISSUE AND COX'S POSITION?

A. Section 22.3 of the agreement, which is currently being negotiated and arbitrated, addresses the circumstances wherein services are continued while a continuation of the agreement is being negotiated. Under Verizon's proposal, if a new agreement is not in place within twelve months of the termination date, the parties would stop operating under the terms of the agreement and replace them with Verizon's Statement of General Terms (the "SGAT"), presuming it has one, or tariff provisions, until a new agreement is reached. Cox believes that this temporary and repeated substitution of agreements is unwarranted so long as the parties are negotiating in good faith or involved in arbitration.

First, experience shows that a twelve-month negotiating period often is not enough. The current Cox-Verizon negotiations started more than two years ago, and the Parties are still months away from obtaining a completed agreement, assuming that there are no administrative appeals of the arbitration determination in this proceeding. Under Verizon's proposed language, the Parties no longer would be operating under their previous agreement, but under Verizon's SGAT or tariffs, and would then return to operation under their new interconnection agreement when this arbitration is completed.

This is not an insignificant consideration. The terms of an SGAT are unlikely to be the same as the terms of an interconnection agreement entered into three years ago. As a

consequence, the Parties would be required to reconfigure their relationship for a short time, and might have to modify their technical arrangements. This reconfiguration is likely to be disruptive to Cox's customers, costly to achieve, difficult to implement within the context of an operating network and of no benefit to any party. Worse, once the Parties reached a new agreement, they would have to reconfigure their relationship yet again, with the same wasteful consequences. There is no reason for either party to incur these costs unless absolutely necessary.

Nevertheless, Cox recognizes that Verizon has legitimate reasons to want to prevent an agreement from remaining in place indefinitely. For that reason, Cox has proposed language that would permit any regulatory body to terminate the agreement upon a showing by Verizon that Cox either has failed to negotiate or is negotiating in bad faith. This language protects Verizon from the possibility that Cox would stall negotiations because of unfavorable changes in the law or for any other reason. Verizon also has the additional statutory remedy, provided under section 252 of the Communication Act, of seeking arbitration from the Virginia SCC or, if the SCC refuses to act, the FCC. The arbitration provisions of section 252 provide the kind of certainty that Verizon has said it wants from the termination provision of the agreement, without unnecessarily disrupting the relationship between the parties. The processes and time period for negotiating a continuation of an existing agreement or a new interconnection agreement under the 1996 Act are well understood. The interim period is fairly well constrained by law and the only exception would be through the mutual consent of Verizon and Cox. Verizon is fully protected as a result. Therefore, Cox has established what it believes is a balanced

position that minimizes the potential for unnecessary costs and provides the best foundation for the negotiations.

Verizon has not explained why it will not agree to Cox's proposal and Verizon's response to Cox's petition for arbitration discusses only WorldCom's proposed language on this issue. (In that regard, I should note that the "compromise" language proposed by Verizon in its response is the same language proposed to Cox before this arbitration began.) For the reasons described above, I believe that Cox's proposal addresses any legitimate concerns that Verizon might have without putting the Parties in the position of having to reconfigure their relationship simply because negotiations have not been conclusive by an arbitrary deadline.

Q. HOW SHOULD THE FCC ADDRESS THIS ISSUE?

A. My recommendation to the FCC is that it approve the language proposed by Cox. That language provides for a continuation of the Verizon/Cox interconnection agreement, in place at the time, while the new agreement is negotiated. The period provided under the 1996 Act for those new negotiations is limited and Verizon will not suffer financial or other harm outside of the terms of the agreement during that time.

ISSUE I-11: VERIZON MAY NOT SUMMARILY TERMINATE COX'S ACCESS TO OSS FOR COX'S ALLEGED FAILURE TO CURE ITS BREACH OF SCHEDULE 11.7 OR SECTIONS 1.5 OR 1.6.

Q. ISSUE I-11 ADDRESSES THE TERMINATION OF COX'S ACCESS TO VERIZON'S OPERATIONAL SUPPORT SYSTEMS ("OSS's"). WHAT IS THE NATURE OF THE DIFFERENCES BETWEEN COX AND VERIZON ON THAT ISSUE?

A. The interconnection agreement contains a termination section (§22.6) that governs the processes and time frames to be used if either Party abrogates the Agreement in whole or in part in material ways. Cox's position is that, because these clauses are applicable to Cox's use of Verizon's OSS, it is not necessary to have yet other processes and times associated with non-compliance related to the use of the OSS. In the hope of settlement, Cox offered to agree that such non-compliance would constitute a material (rather than non-material or minor) breach of the Agreement and that the processes and time frames applicable to material breaches would therefore apply. This proposal would allow Verizon to use all of its powers under the "Term and Termination" section of the agreement and, from an administration viewpoint, should be sufficient.

Verizon's response is that complete compliance with OSS requirements is essential to Verizon, but it does not explain why. Since the time Cox first began using Verizon's OSS in Virginia, Verizon has provided no indication that Cox ever has used that OSS in any way that could be harmful to Verizon or other OSS users. This track record demonstrates that onerous remedies are unnecessary. Further, Verizon's proposed language assumes that all violations of OSS requirements are so harmful that any violation would justify immediate suspension of OSS access, but the response provides no basis for applying the same remedy to all violations. In the absence of such a demonstration, there is no reason to adopt a different remedies for violation of OSS requirements than for other breaches of the agreement.

Q. HAS COX PROPOSED APPROPRIATE LANGUAGE IN ITS PETITION FOR ARBITRATION TO RESOLVE THIS ISSUE?

A. Yes, the language covers the points I have made above.

Q. DR. COLLINS, DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes, it does.

EXHIBIT A

CV OF DR. COLLINS

PROFESSOR FRANCIS R. COLLINS

Dr. Collins is a senior member of the International Telecommunications Industry. He has made significant contributions to the science, engineering, business development and evolution of that industry. His professional science and engineering focus over the years has been the System Architecture, Design and Implementation of large scale public and private telecommunications and teleprocessing systems and networks. A few of the many possible examples are: the design and creation of the fundamental plan which included operations, finance, technology and training for the Public Switched Network in Saudi Arabia; a technical audit and re-engineering of the communications and telemetry systems serving the oil and gas fields in Algeria; the specification for operational and technology improvements in NIRT, the National Iran Television Company; numbers of technical and economic audits of operating telephone companies in the United States; the technical audit and specification for quick fix technical improvements to the local exchange plant for CANTV, the telecommunications provider in Venezuela; the establishment of a strategy for and the technical evaluation of the proposals for the alternative telephone company in Australia; the establishment of competitive strategies for the National and International telephone companies in Australia; a technical, organizational and financial "due diligence" study including vendor recommendations for a 2,000,000 line switched telephone and broadband telecommunication project in Thailand; and from the commercial section a few examples are: the design and architectural implementation of the Florists' Transworld Delivery (FTD) Mercury Network in North America; the design of corporate nationwide telecommunications and teleprocessing systems for a host of industrial clients and the provision of technical and economic counsel to communications co-carriers.

Dr. Collins, among other professional assignments, has served as an advisor on Information and Technology to Governor Weld (Massachusetts). In addition, he has served as member of the Board of Directors of both the Massachusetts Society of Professional Engineers and its Metropolitan Boston Chapter.

While a teaching professor, a Dean of Engineering, and a Provost of the University at Boston University, Dr. Collins provided consulting services in: Public Policy; Business Analysis; Revenue Production Strategy Development; the application of Science and Engineering to the

design and development of public switched networks; and Economic and Financial Counsel. This work has been done for the national and international telecommunications, cable television, and information technology community.

Dr. Collins' own applied research is in the design and implementation of unique communications, teleprocessing and information technology systems and the requisite requirements analysis and system design. In addition Dr. Collins has pursued an intellectually stimulating aspect of being a telecommunications scientist and professional engineer, that of addressing issues related to Public Switched Telecommunication System Design, Telecommunications Public Policy Development; Telephone Operating Revenue Requirements and Rate Design Issues for Developed and Developing Countries across the world. In addition the technological, economic and public policy concerns and issues to be faced in the introduction of technology and competition into those public telecommunication and broadband networks. For the past few years Dr. Collins' interests have centered on the introduction of deregulation and competition to the interLATA, intra-state toll, and most recently the local exchange marketplace.

Recently, specific areas of work have included:

- Providing economic and technical counsel to state governments and the representation of co-carriers in negotiations between LECs and CLECs to arrive at co-carrier agreements which satisfy the 1996 Act requirements, currently in California, Connecticut, Idaho, New Hampshire, Massachusetts, New York, Nevada, Oklahoma, Rhode Island and Virginia;

- The determination of the approach for, and subsequent review of, Total Service Long Run Incremental Cost Studies for the establishment of cost elements (and subsequently rates) for unbundled local exchange networks;

- The provision of technical and economic counsel to and representation of parties in TSLRIC/TELRIC cost methodology development workshops, whose goals are to make recommendations to regulatory bodies;

- Member of the Connecticut Telecom Industry Operations Task Force which was established by the Connecticut Commission;

- Member of the State of Connecticut Technical and Economic Task force providing oversight to the implementation of Alternative Regulation for SNET;

- Technical Counsel to the Connecticut Carrier Change Process sub-committee established by the Connecticut Commission;

- Member of the State of California PUC E911;

- Member of the State of California Local Number Portability Task Force since its inception in 1995;

- Representative to the West Coast Number Portability Limited Liability Corporation;

- Member of the State of California Task Force on Billing and Routing;

- The provision of Technical and Economic Counsel to the California Association regarding: NPA/NXX issues; New Regulatory Framework issues; Local Competition Rule issues; issues underlying Local Number Portability; the Provision of Emergency Services; Open Network and Network Architecture Issues, and the implications of the Telecommunications Act of 1996;

- Technical and Economic Audits for Operating Telephone Companies, focusing on the Construction Program, the resulting Capital Investment, and its effect on the Rate Base;

- The design of a multi-variable computer program for doing first cost and upgrade costs of CATV and Video Dialtone Broadband Networks;

- The review and analysis of proposed Capital Programs and the proper allocation of costs to regulated and competitive services for local exchange operating telephone companies;

- The assessment of proposed Rate Design Structures and their relationship to the Capital Investment and the utility of that investment;

- The technical audit of portions of the CANTV Network in Venezuela with the recommendation for immediate and cost effect upgrading of that network through the evolutionary introduction of technology to the Capital Program;

- For the government of Australia, the evaluation of the optimum manner of introducing a significant advanced technology expansion to the existing network through the establishment of a "Second Carrier" for domestic local and long distance service;

- The managerial oversight of the design and implementation of a comprehensive training program in Saudi Arabia;

- The development of a major 124 hour technical training program in telecommunications and advanced broadband services for NYNEX. The program ran three years and over 1,200 staff members were trained;

- The technical and economic audit of a 2,000,000 line, 2.8 billion dollar expansion of the public network for video, data and voice services in the greater Bangkok, Thailand area for an investment banking firm's due diligence effort;

- The Creation of the Fundamental Plan for the terrestrial and satellite based Public Switched Network for Saudi Arabia for; Operations, Revenue Requirements, Tariff Structures, Organizational Structures and Technology Introduction;

- The Creation of the Specifications for the Loop, Switching and Trunking Equipment to Implement the Saudi Arabian Public Switched Network;

- The Architectural Oversight of the Implementation of the Public Switched Network in Saudi Arabia;

- The Analysis and Synthesis of an International Gateway Network using Space Satellite Links for Saudi Arabia;

- The Design of a National Video and Digital Data Network for National Iranian Television;

- The Analysis leading to recommendations for rectifying problems in the Telecommunications supporting the gas and oil fields in the Algerian Sahara;

- The design of a Space Satellite International Gateway Complex to support international communications to/from The Republic of Vietnam;

- The Planning and Design for a Voice and Data terrestrial and Satellite base Telecommunication System for the Provision of Educational and Medical Services to remote regions in the United States;

- The analysis required for the design and then the design, installation, staff training, and establishment of operational and cost control systems for nationwide voice, television and data networks for private industry and national governments. These include projections of needed telecommunications capacity and services based on Operational Research methods applied to the particular situation;

- The Architectural Design; Public Policy Impact Analysis; and Financial Impact Assessment; System and Subsystem Specification; Integration, Test and Evaluation of Large Scale Teleprocessing systems;

- The specification of components for nationwide on-line, real time voice/data systems employing thousands of terminals;

- The architectural design and engineering specification for mobile telephone systems considering the cost performance aspects of standard vs. cellular configurations;

- The integration of cellular signaling and billing transmission protocols with Equal Access, Feature Group D formats;

- The evaluation of start-up companies and their products for investors or venture capital concerns;

Dr. Collins has had thirty eight years of experience as a systems engineer, engineering manager, executive and senior consultant in the telecommunication, navigation and digital electronic fields. He is recognized as an international expert in telecommunications, science, technology, economics and public policy. As a member of technical, middle and top management levels, he has held marketing, profit, overhead, cost, planning, and administrative control positions for a number of top companies: Bell Telephone Laboratories, the MITRE Corporation, the Magnavox Company, Analytical Systems Corporation, Arthur D. Little, Inc., and Boston University.

His Executive Management positions have included:

- Executive Project Manager, the MITRE Corp.;
- Director, the Magnavox Communications Research Laboratories;
- Executive Vice President, The Analytical Systems and Engineering Corporation;
- Dean of the College of Engineering, Boston University;
- President, CCL Corporation.

He is the author of over 100 technical papers and has processed patents in the design of telecommunications, information technology, and multi-media broadband networks and equipment. He currently is in the process of perfecting two patents related to the "convergence" of the cable and telephone industries. In addition, he has accomplished work and published confidential reports in the areas of requirement analysis and telecommunications system performance and design for the Army, Navy and Air Force. These systems, both satellite and

terrestrial, typically employed advanced modulation techniques, equipment and systems to support generic mission profiles.

Dr. Collins was awarded the B.S.E.E. degree, *cum laude*, at Northeastern University and the M.S.E.E. degree with high honors as part of Bell Telephone Laboratories Educational Program. This certificated program involved additional higher education above the Masters degree level. These courses were taken at the Massachusetts Institute of Technology and in residence at the Laboratories. In that work his educational emphasis was on digital switching and network transmission systems. His doctorate (Ph.D.) in Telecommunications was awarded by the Union Graduate School. In addition to being a professional member of the faculties of Lowell University, Northeastern University and Boston University, in 1996 Dr. Collins was appointed to the "International Academy" in the position of Academician by the Faculty of the University of Moscow, St. Petersburg, Russia.

Dr. Collins has been a Professor of Engineering of the undergraduate and graduate school faculties of Northeastern University, Lowell University, and Boston University. His academic career includes the organization and presentation of courses in the areas of: digital computer/electronics; solid state circuit design; synthesis of linear passive bilateral networks; the theory of time varying fields; the theories of dynamical systems with applications of classical (transform calculus techniques) and modern (state space formulations) solutions; communications theory and the design of communications systems. He was a Professor of Engineering and the Associate Dean for Research at the College of Engineering at Boston University from 1976 to 1978 and Associate Provost, a position similar to Executive Vice President, responsible for the research activity of the University with responsibility for The Office of Research Programs from 1978 to 1981. During this tenure at Boston University Dr. Collins was sought after for consulting services by national and international businesses, industries, and governments and provided these services to the extent allowed by this faculty affiliation.

From 1981 to the present he has been providing consulting services through CCL Corp. and additionally is "Of Counsel" to a number of other distinguished firms including Arthur D.

Little, Cambridge Strategic Management Group, Exeter Associations, and J.W. Wilson Associates.

Dr. Collins is a registered Professional Engineer in the Commonwealth of Massachusetts; a member of both the Massachusetts and National Societies of Professional Engineers; a past Vice President and current Executive Board Member of the Massachusetts Chapter, a member of the Legislative and Government Affairs subcommittees of the National and Massachusetts Societies, a member of two national engineering honor societies; Eta Kappa Nu and Tau Beta Pi; a past member of the Institute of Electrical and Electronics Engineers; a member of the National Society of Engineering Educators; and a member of the National Association of Cable Television Engineers. He has served on numbers of National and International professional advisory boards, panels, and North American Standards setting Organizations over the years, and has served internationally as a member of the International Telecommunications Union in Geneva, Switzerland. Dr. Collins is also an elected member of "Who's Who Worldwide."